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He is also conscious that the phenomena themselves are the chief ground on which he can rest a claim for originality, and that the explanation of them may be better treated by those who are more accustomed to deal with similar researches.

In the course of these experiments the author has been especially indebted for many valuable suggestions to the Rev. Dr. Booth, Dr. Roget, Professor Sharpey, and Mr. Bishop; and he is also under obligations to Professor Stokes and to Mr. Brooke.

XII. "On the Constitution and Properties of Ozone." By  
THOMAS ANDREWS, M.D., F.R.S., Professor of Chemistry  
in Queen's College, Belfast. Received May 16, 1855.

The conflicting views which have so long existed as to the true constitution of ozone, induced the author to undertake a careful investigation of the subject, particularly as he had reason to doubt the accuracy of the only quantitative experiments which have yet been made to elucidate this difficult question. According to the experiments referred to, two substances have been confounded under the name of ozone, one a compound body having the formula  $\text{HO}_3$ , the other an allotropic variety of oxygen. To ascertain whether, in conformity with this statement, ozone obtained in the electrolysis of water contains hydrogen as a constituent, the author made two series of experiments. In the first series, he followed nearly the same method of investigation by which its compound nature is supposed to have been established, but modified so as to avoid a source of error, which, if neglected, vitiates altogether the results. Electrolytic oxygen, unless very great precautions be taken, is always accompanied by a small but appreciable quantity of carbonic acid, which is liable to be partially absorbed by the potassa set free when a neutral solution of iodide of potassium is decomposed by ozone. By adding a little hydrochloric acid to the solution of iodide of potassium before the commencement of each experiment, this error may be avoided.

The method of performing the experiment was to conduct a stream of electrolytic oxygen through a compound apparatus previously

weighed, which contained on one side an acid solution of iodide of potassium, and on the other sulphuric acid; the former to decompose the ozone, the latter to prevent the escape of moisture. The increase in weight of this apparatus gave the entire weight of the ozone; the iodine set free, when reduced to its equivalent in oxygen, the weight of the active oxygen. The precautions to be taken in conducting this experiment are fully described in the communication.

The following are the numerical results of five experiments performed according to the above method:—

| Volume of electrolytic oxygen. | Increase in weight of compound apparatus. | Active oxygen deduced from iodine set free. |
|--------------------------------|---|---|
| litres.                        | gm.                                       | gm.   |
| 10·20                          | 0·0379                                    | 0·0386                                      |
| 2·72                           | 0·0107                                    | 0·0100                                      |
| 2·86                           | 0·0154                                    | 0·0138                                      |
| 6·45                           | 0·0288                                    | 0·0281                                      |
| 6·80                           | 0·0251                                    | 0·0273                                      |
| Total . . . . .                | 0·1179                                    | 0·1178                                      |

The agreement in these numbers proves that the active oxygen is exactly equal to the entire weight of the ozone, and is therefore identical with it.

In the next series of experiments the author shows that no water is produced in the decomposition of electrolytic ozone by heat. Large quantities of electrolytic oxygen, containing from 38 to 27 milligrammes of ozone, were decomposed by heat, but no water was obtained in a weighed absorption apparatus, in which the gas was exposed, not only to the action of sulphuric acid, but was also passed through a tube containing anhydrous phosphoric acid.

Having confirmed by new experiments the fact that ozone is formed by the action of the electrical spark on pure and dry oxygen, the author proceeds to institute a comparison between the properties of ozone derived from different sources. These he finds to be in every respect the same. Thus ozone, however prepared, is destroyed, or rather converted into ordinary oxygen, by exposure to a temperature of about 237° C., and catalytically, by being passed over peroxide of manganese, no water being formed in either case; it is not absorbed by water, but when sufficiently diluted with other

gases, is destroyed by agitation with a large quantity of water; it is also, contrary to the common statements, destroyed by being agitated with lime-water and baryta-water, provided a sufficient quantity of those solutions be used; it has always the same peculiar odour; it bleaches without producing previously an acid reaction; it oxidizes in all cases the same bodies, &c.

From the whole investigation the author draws the conclusion, "that ozone, from whatever source derived, is one and the same substance, and is not a compound body, but oxygen in an altered or allotropic condition."

### XIII. "On Rubian and its Products of Decomposition."—

Part III. By EDWARD SCHUNCK, F.R.S. Received June 13, 1855.

#### *Combined Action of Alkalies and Oxygen on Rubian.*

In the preceding part of this paper the author has shown that the action of alkalies is essentially the same as that of acids on rubian, the only difference being that the rubianine produced by acids is replaced by rubiadine when alkalies are employed. Now though this is in all cases the final result of the action of alkalies, there still remained a possibility of the existence of bodies intermediate between rubian and the final products of decomposition. Such bodies do in reality exist, but their formation is dependent, in part at least, on the simultaneous action of oxygen.

When alkalies or alkaline earths, as potash, soda, ammonia, baryta or lime, or the bicarbonates of baryta or lime are added to a watery solution of rubian, and the solution is exposed to the air, oxygen is absorbed, and three distinct bodies are formed, to which the author has given the names of *Rubianic Acid*, *Rubidehydran* and *Rubihydran*. The method of separating these bodies and obtaining them in a state of purity is fully detailed. Even oxide of lead is a sufficiently strong base to cause rubian to undergo this process of decomposition in the presence of oxygen. From this cause the lead compound of rubian, after being exposed for some time to the atmosphere, no longer contains unchanged rubian, but products of its decomposition; and hence also it follows that in the processes pro-